

# Cooling efficiency results in savings of 40%

*submitted by the Danish National Team*

*An investment of DKK 1.2 million has resulted in yearly savings of DKK 300,000 as well as improved quality of the ice in a local ice rink in Odense, the third-largest town in Denmark.*

Built in 1976 the ice rink was a genuine glutton for consuming energy. The ice rink is used by ice hockey players, the skating and curling clubs, schools, as well as about 30,000 "public skaters" a year.

To reduce energy consumption and to save money a careful analysis was carried out. This made it clear that up to 40% of the money spent on energy consumption could be saved.

## Two basic principles

Energy advisor to the municipal authorities who run the ice rink, engineer Franz Zitz of Zitz Engineering Consultants, explains the savings as the result of two main ideas. Firstly, using energy during the hours when energy is cheap, (Odense has a triple tariff, with the lowest price at night when consumption is at its lowest), "storing" the cold via automatic controls and using it during the expensive hours. Secondly, using osmotic water - water that no longer contains any salts after a pressure process (20 atmospheres). Osmotic water freezes much quicker than tap water. The programme also involves re-using the iced osmotic water which is planed off 8-10 times a day and replaced with a thin layer of warm water (the water has to be warm to ensure a proper melting process). If the water is too cold, a peeling effect may occur. The total ice layer is about 3 cm thick, -4°C at the bottom and 1-1½°C at the surface. Eighty per cent of the water can be re-used. Each time a new layer is put on, 700-800 litres of water are used.

Hockey players prefer "hard" (cold) ice, whereas figure skaters prefer softer ice, which can be arranged. The thickness of the ice layer is monitored frequently, and new ice is added for safety whenever necessary.

## "Osmotic" advantages

This is the first time osmotic water has been re-used for this purpose in Denmark. The consultant was inspired by an

article about the winter Olympics in Calgary, Canada. Osmotic water offers several benefits. The ice is clearer, thus making it easier to see the markings (and any adverts, too). The strength of the ice is improved, and the amount of energy is reduced, as the temperature of the osmotic water, when melting together with the existing ice, is 30°C compared to 50°C previously. Excess heat from the renovated refrigerating plant is used to heat the water, as well as to dehydrate and heat the atmospheric air before it goes through the ventilation system into the hall.

With a low air humidity the temperature in the hall can be lowered to 8°C (compared to an earlier 12°C). This saves energy when heating the hall and allows the ice machine to leave out one drive a day, saving manpower, petrol and one grinding of the machine blades. Finally, the osmotic salt-free water does not dull the blades as much as tap water.

Odense ice rink is now as renovated and "energy-conscious" as it can be without very expensive investments. Today a new ice rink would be located next to, for instance, a swimming pool for optimal use of surplus heat, and the basic construction would be different.

## Key figures

- Reconstruction of ventilation plant: district heating savings of 7,422 m<sup>3</sup> of gas a year which is equivalent to 433,380 kWh.
- Hot water production (renewal of ice - re-use of water): district heating savings of 1,080 m<sup>3</sup> of gas a year, equivalent to 50,110 kWh.
- Reverse osmosis: electricity savings of 58,300 kWh a year.
- Hot water production (showers): district heating savings of 1,020 m<sup>3</sup>, equivalent to 47,300 kWh.
- Electricity savings due to more economical compressor times (night) 126,700 kWh.
- A total electricity saving of 185,000 kWh a year.
- A total district heating saving of 9,522 m<sup>3</sup> a year/ 441,790 kWh a year.
- Water savings: 613 m<sup>3</sup> a year.

*Further information is available from the Danish National Team (address on back cover).*